<u>Quadratic Programming: Manufacturing Problem</u>

Reference:

Book Title: Engineering Optimization theory and practice
Author(s): Singiresu S.Rao
Publisher : John Wiley and sons Inc
Edition : Fourth

Problem:

A manufacturing firm produces two products, A and B, using two limited resources. The maximum amounts of resources 1 and 2 available per day are 1000 and 250 units, respectively. The production of 1 unit of Product A requires 1 unit of resource and 0.2 unit of resource 2, and the production of 1 unit of product /b requires 0.5 unit of resource 1 and 0.5 unit of resource 2. The unit costs of resources 1 and 2 are given by the relations (0.375-0.00005u1) and (0.75-0.0001u2), respectively, ui denotes the number of units of resource i used (i=1, 2). The selling prices per unit of products A and B, pa and pb are given by
pa=2.00-0.0005xa-0.00015xb
pb=3.50-0.0002xa-0.0015xb

where xa and xb indicate, respectively, the number of units of product A and B sold. Formulate the problem of maximizing the profit assuming that the firm can sell the units it manufactures.

How to use the code:
This code is made to test quadprog function which solves the linear quadratic problem. The code is tested using a manufacturing problem specified above.
To use the function, we need to pass some parameters which are needed to be specified by the user.

First, the number of variables and then, number of constraints are to be provided.

Now, the user is asked to put the coefficients of the non-linear variables in the objective function which can be taken from the objective function mentioned in the mathematical Formulation below. This will create a matrix having dimension of [nbVar][nbCon].

The user is asked to enter the coefficients of linear variables used in the objective function and a vector is created.
The user is then asked to specify the coefficients of the variables present in the constraints in the formulation which are stored in the vector if dimension nbVar.

Then user needs to enter the values present in the right hand side of the constraints.
As the parameters are entered, the program will calculate the values of the units and the cost using the quadprog function which are displayed on the screen.

Mathematical Formulation:

Objective Function : F= -xb(3.5-0.0002xa-0.0015xb) subject to constraints
-0.5xb<=1000
0.2xa+0.5xb<=250
xa>=0
xb>=0

Function used:

xopt = quadprog(nbVar,nbCon,H,f,lb,ub,A,conLB,conUB,x0,options)
where

- nbVar : A double, denoting the number of variables
- nbCon : A double, denoting the number of constraints
- H : A symmetric matrix of doubles, representing the Hessian of the quadratic problem.
- f : A vector of doubles, representing coefficients of the linear terms in the quadratic problem.
- lb : A vector of doubles, containing the lower bounds of the variables.
- ub : A vector of doubles, containing the upper bounds of the variables.
- A : A matrix of doubles, representing the constraint matrix in conLB ≤ A·x ≤ conUB.
- conLB : A vector of doubles, containing the lower bounds of the constraints conLB ≤ A·x ≤ conUB.
- conUB : A vector of doubles, containing the upper bounds of the constraints conLB ≤ A·x ≤ conUB.
- x0 : A vector of doubles, containing the starting values of variables of size (1 X n) or (n X 1) where 'n' is the number of variables.